EXTENSION NOTE

forest sciences
NELSON FOREST REGION

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Case Study: Application of a Selection Silvicultural System in the ICHwk1 of the Columbia Forest District

By Lauren Waters

■ **Despite higher costs for logging, the reduced stumpage, a high percentage of high value logs, and minimal pulp volumes allowed RCFC to profitably log this area.**

BACKGROUND

In the winter of 2000, the Revelstoke Community Forest Corporation (RCFC) implemented a single-tree selection silvicultural system in second growth in the Wells Gray Interior Cedar–Hemlock wet cool variant (ICHwk1).This silvicultural system was implemented to address a number of issues, including: maintaining ungulate winter range, recruiting caribou habitat, minimizing visual impacts, improving future wood quality, allowing more flexibility in harvest scheduling, and minimizing volume loss through western white pine mortality.

Harvesting operations in the Revelstoke area have been concentrated in old growth. The timber profile within RCFC's tree farm licence (TFL) is dominated by old growth (approximately 50% is age class 8 and 9). Less than 7% of the profile is comprised of stands aged 60–140, which are candidate areas for single-tree selection.

This particular single-tree selection silvicultural system has three objectives:

1. to produce a healthy, uneven-aged, mixed-species stand of Douglas-fir, western redcedar, Engelmann spruce, western hemlock, western white pine, trembling aspen, and birch sawlogs;
2. to maximize snow interception and thermal cover by maintaining a high proportion of crown closure; and
3. to minimize the visual impact of harvesting as viewed from Highway 23 North.

SITE DESCRIPTION

The site is approximately 38 km north of Revelstoke, adjacent to Highway 23 North and approximately 100 m above Lake Revelstoke Reservoir (Figure 1). The 13-ha mixed-species stand lies within the Interior Cedar–Hemlock wet cool variant (ICHwk1), and the elevation ranges from 585 to 675 m.

As determined from the oldest trees now on site, a hot forest fire probably occurred about 1900. The many cedar stumps likely resulted from a logging operation about the same time as the fire. Because of the state of stump decay, it was impossible to determine if harvesting occurred before or after the fire. Many of the hardwoods and smaller stems were cut during Employment Bridging Assistance Program spacing operations in the early 1980s. The resulting stand is relatively open and has a significant component of advanced regeneration scattered throughout.

The pre-harvest stand is a thrifty, mixed-species stand of Douglas-fir (40%), western hemlock (24%), western redcedar (20%), Engelmann spruce (3%), western white pine (5%), paper birch (5%), and cottonwood and trembling aspen (3%)(Figure 2). The age of the merchantable stems ranges from 40 to 85 years old (taken at breast height). This stand consists of approximately 362 stems per hectare (sph) of mature timber (layer 1), 150 sph of poles (layer 2), 1100 sph of saplings (layer 3), and 2000 sph of advanced regeneration (layer 4). The volume before harvesting was 253 m^3/ha gross and 239 m^3/ha net. The basal area is 29.2 m^2/ha.

The terrain is mostly gentle. Slopes range from 15 to 70% with an average of 15%. The terrain steepens at the east end of the block. The soils are relatively coarse forest Podzols with a moderate to high coarse fragment content. The LFH layer is thin (4–6 cm). Parent materials are morainal tills and fluvial gravels. Armillaria root

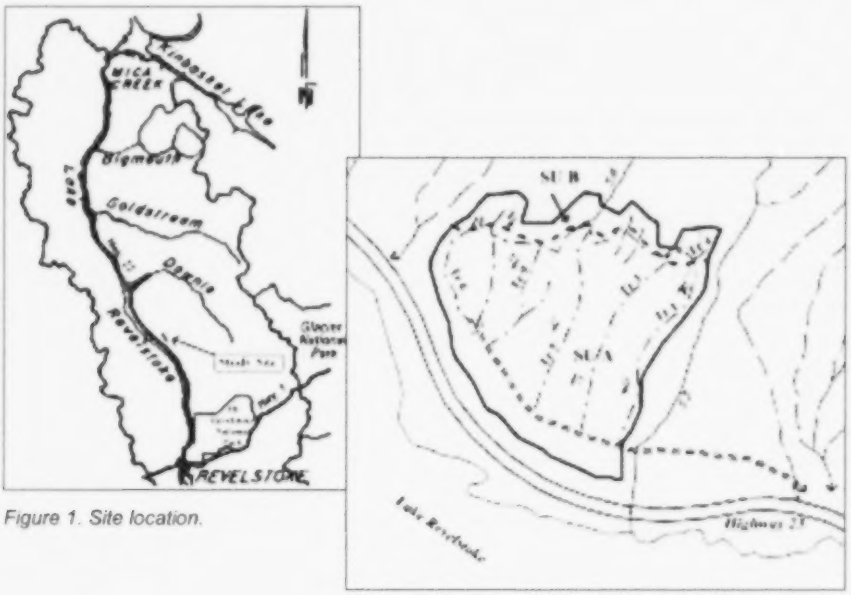

Figure 1. Site location.

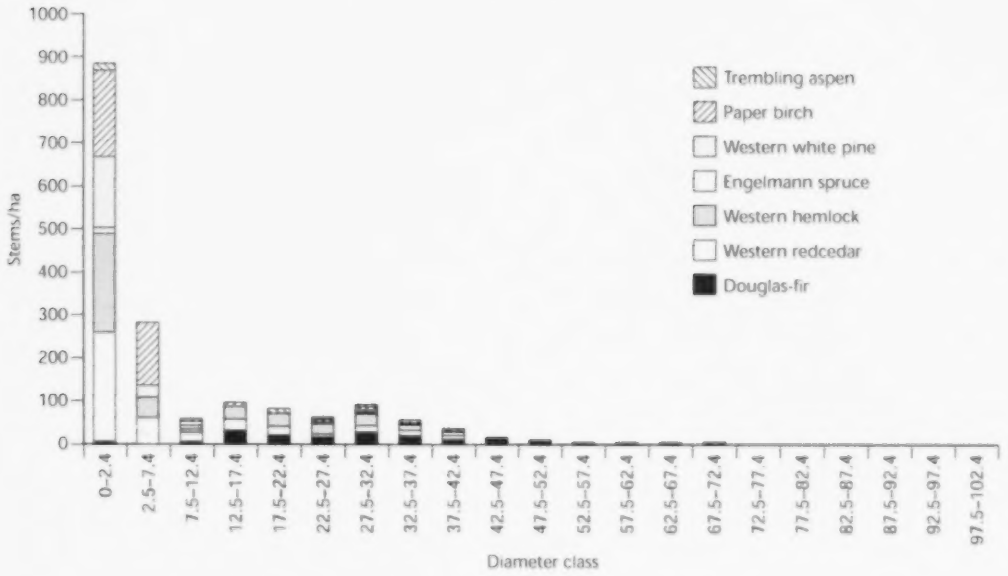

Figure 2. Pre-treatment stand structure (1999).

rot and white pine blister rust are prevalent throughout this stand. An S3 fish stream (Cap Creek) runs outside the block boundary to the east. A 40 m wide reserve area lies along the S3 stream. A few seasonal spring watercourses (non-classified streams) and one seasonal S6 stream within the block do not run into Lake Revelstoke or Cap Creek but disappear into the coarse soil.

This block consists of two different standards units (SUs), based on a difference in slope and site sensitivity. The terrain in SU A is gentle: the slopes range from 15 to 25%,

with an average of 15%. The slopes in SU B range from 40 to 70%, with an average of 45%.

PLANNING AND LAYOUT

Planning by RCFC at the forest development plan stage identified that this block is within the ungulate winter range, caribou management zone (currently immature), and intermediate biodiversity zones as identified in the Ministers Advisory Committee Draft Plan. Moose and deer extensively use this area, as seen from heavy browsing throughout the block. Caribou likely under-use this area because of the young stand age. The single-tree selection system will maintain a mature canopy to provide security, thermal, and suitable snow interception cover required to facilitate movement and foraging opportunities. It will also establish an ongoing example of uneven-aged management and its potential to create caribou habitat.

All skid trails were located and traversed before harvesting. Information on sub-merchantable stems was collected during the cruise, and an additional survey documented the level of root rot. Approximately 20% of the trees are infected with Armillaria root rot, and a further 37% of the trees show signs of infection. RCFC will monitor the effects of single-tree selection on the spread of the root rot. If Armillaria root rot levels increase significantly, the prescription may change to address this issue. The prescription states that the area should be managed for mixed species, including hardwoods, to minimize the pest and disease impacts.

Before harvesting, all stems to be cut were marked with orange paint at breast height using the following criteria:

- Remove approximately 15–25% of the basal area (6–7 m^2/ha) in the first entry. Percentage removal does not include amount removed in permanent access structures such as skid trails, roads, and landings.
- Select a proportional range of species and diameter classes.
- Harvest unhealthy, poorly formed stems first.
- Where feasible, select small groups of trees, especially where the crowns are intertwined.
- Minimize damage to the advanced regeneration, saplings, and poles.

The prescription was flexible so that the faller could choose an alternate tree if it was not possible to fall the marked tree.

PRESCRIPTION

- The silvicultural system for this block is single-tree selection. Sometimes, very small groups (under 0.01 ha) will be created within the stand. The site will be managed as an uneven-aged, mixed-species stand with entries every 20 years. The stand will be re-cruised before scheduling re-entries.
- The long-term stand structural goals are:
  1. to approximate a classic J-shaped diameter-class distribution (Figure 3) (this will take several harvest entries to attain); and
  2. to manage for a mix of species (cedar, hemlock, Douglas-fir, spruce, western white pine, birch, and aspen).
- There are presently deficits in the less than 25 cm dbh classes and small surpluses in the classes greater than 25 cm. Most of the trees harvested in

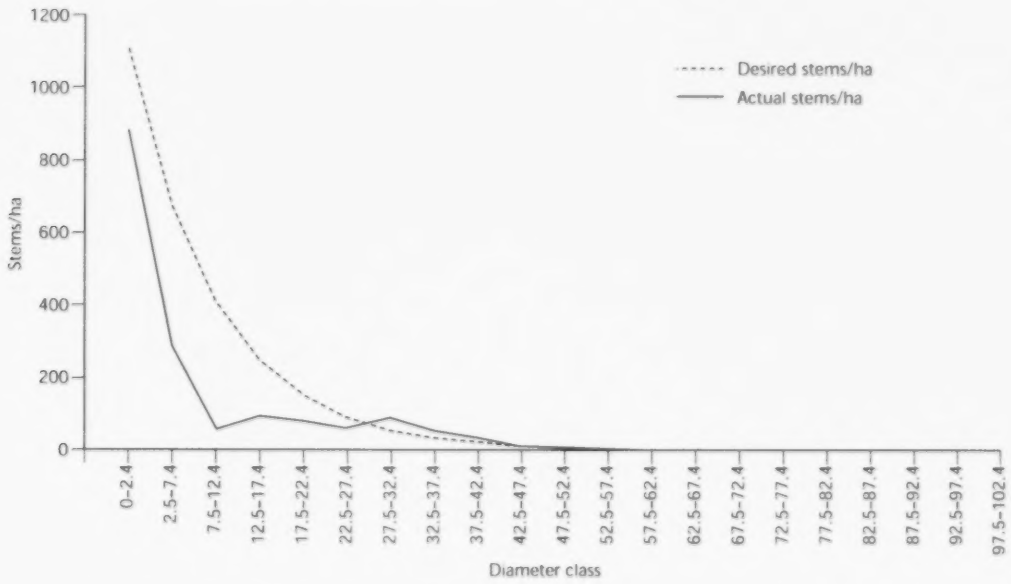

Figure 3. Long-term stand structural goal vs. actual stems per hectare.

this first entry will be from these surplus classes, except the removal of poor-quality growing stock and road and skid trail clearings.

- *Small* group (10–20 m diameter) removal on a small proportion of the site will be used to recruit the shade-intolerant species. This will increase the amount of available light to encourage the regeneration and growth of Douglas-fir (Fdi), western white pine (Pw), and hardwoods. Fdi and rust-resistant Pw will be fill planted in the openings to increase their relative proportion in the stand.
- Retain approximately 20% of the hardwoods where feasible to maintain a mix of species to help mitigate root rot.
- Many of the Pw have blister rust; therefore, a higher percentage of Pw will be removed in the first entry.

HARVESTING

Harvesting started in the winter of 1999 using a Jonsered tracked Ironhorse (9 horsepower). However, the Ironhorse was not powerful enough to yard full-length logs, which had to be bucked into short, less valuable, lengths. Harvesting was postponed until suitable machinery and an operator were available. In the winter of 2000 a small crew of three, using a TD8 Caterpillar, harvested the area in 15 days (Figure 4). This machine was able to skid two or three full-length logs downhill; however, the trees had to be bucked for adverse skidding. Harvesting the deciduous stems did not work well because the crowns were large and intertwined, causing hang-ups and damage to the residual stems. Consequently, only one load of birch was harvested before the decision was made to leave the remainder of the marked hardwoods.

Rub trees were used to protect residual stems where required. Heavily damaged rub trees were removed after harvesting. Heavily damaged trees (in layer 1) were defined as having scars greater than 150 cm^2 on hemlock and greater than 250 cm^2 on all other species. The damage criteria were meant as a guideline only; ultimately, RCFC staff examined damaged trees and decided their fate. For example, a heavily damaged rub tree may be left as a rub tree for the next entry or may be desirable as a wildlife tree. Production for the operation averaged approximately 68 m^3/day.

Approximately 2.1 km of permanent skid trails were constructed to access the block. These trails are included as part of the permanent access structures and will not be regenerated between harvest entries. Trails on the steeper part of the block were kept to a minimum.

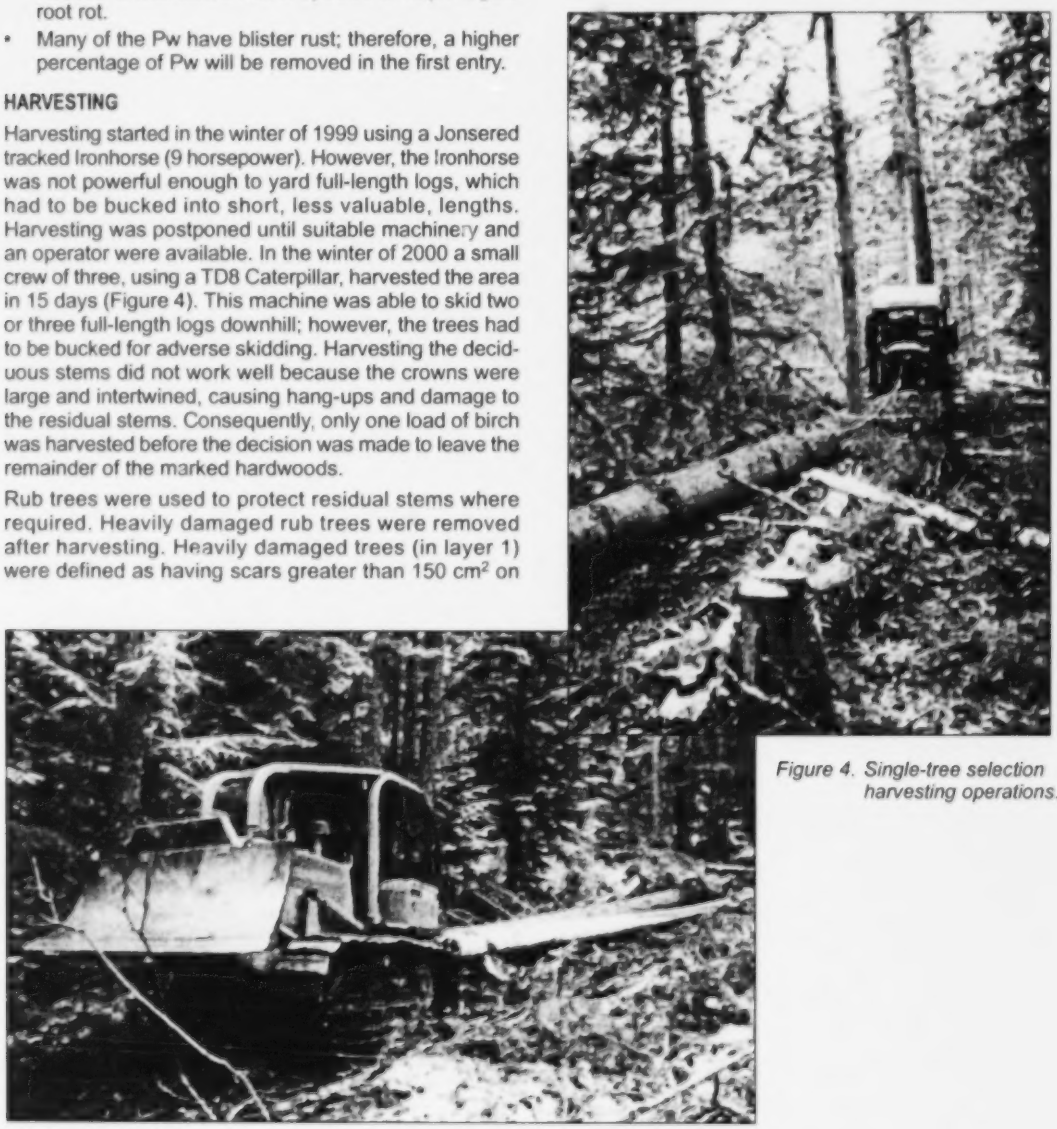

Figure 4. Single-tree selection harvesting operations.

COSTS

Despite higher costs for logging, the reduced stumpage rage ($0.25/m^3), high percentage of higher-value logs, and minimal pulp volumes allowed RCFC to profitably log this area. The costs per cubic metre are as follows:

	Single-tree selection harvesting	Average clearcut harvesting
Layout	$15.21/m^3*	$3.50/m^3
Logging	$30.00/m^3	$21.00/m^3
Hauling	$5.94/m^3	$5.94/m^3
Total	$51.15/m^3	$30.44/m^3

* Includes tree marking.

The actual costs per hectare for the layout are not significantly higher than that for a clearcut, except for the additional costs of tree marking. However, the low first pass volume removal, and lower logging production, greatly increase logging costs compared with clearcut harvesting.

Layout costs for this block were high, partially because this was the first single-tree selection silvicultural system tried by RCFC. Combining surveys and laying out skid trails using a quick string line traverse could reduce these costs in the future. The harvesting costs will decrease with more experience in tree marking and prescription development.

MANAGEMENT LESSONS

Minimizing layout costs is important to ensure a profitable operation. The choice of machinery can make a large difference in profitability—the machinery must be able to full-tree skid to ensure that the highest-value products can be realized. The equipment must be large enough to handle the desired products, such as poles versus sawlogs.

Marking the trees while retaining flexibility to substitute other trees is needed for success. If the plan includes harvesting hardwoods in the future, it would be more appropriate to use a group selection to facilitate their removal and reduce damage to residuals.

SUMMARY

Single-tree selection harvesting in second-growth stands in sensitive areas to address ungulate winter range, recruit caribou habitat, and improve future wood supply is feasible. Although the cost per cubic metre is high, this approach may help to offset volume reduction and improve the availability of merchantable timber on RCFC's TFL in 40 years, when a shortfall is predicted. As crews become more experienced in layout, prescription development, and harvesting, costs will decrease. This harvesting method allows access to timber that would otherwise be unavailable for clearcutting due to higher-level plan constraints for ungulate winter range, caribou habitat recruitment areas, and biodiversity.

This area will be monitored for future stand development, including suitability for ungulate winter range, caribou habitat recruitment, and spread of Armillaria root rot. All of these variables will be considered before scheduling the next entry, which is tentatively planned in approximately 20 years.

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